CLAIMS

What is claimed is:

1. A process for forming a photopolymerizable element useful as a flexographic printing plate having at least one layer of particulate material comprising:

forming a layer from a molten photopolymerizable material onto a support; and

applying the particulate material onto an exterior surface of the photopolymerizable layer opposite the support within 48 hours of forming the layer of photopolymerizable material.

2. The process of Claim 1 wherein the layer of photopolymerizable material has an exterior surface opposite the support and the exterior surface has a temperature greater than 30 °C.

3. The process of Claim 2 wherein the exterior surface has a temperature between 35 and 100 °C.

4. The process of Claim 2 wherein the exterior surface has a temperature between 40 and 90 °C.

5. The process of Claim 1 wherein the applying of the particulate material occurs within 24 hours of forming the photopolymerizable layer.

6. The process of Claim 1 wherein the applying of the particulate material occurs within 16 hours of forming the photopolymerizable layer.

7. The process of Claim 1 wherein the applying of the particulate material occurs within 2 hours of forming the photopolymerizable layer.

8. The process of Claim 1 further comprising:

altering temperature of the layer of photopolymerizable material by heating or cooling the support side of the layer.

9. The process of Claim 1 further comprising:

altering the temperature of the exterior surface of the photopolymerizable layer by heating, cooling, or a combination of heating and cooling, after forming the photopolymerizable layer.

10. The process of Claim 1 wherein the support is a cylindrically-shaped sleeve.

11. The process of Claim 10 further comprising:

supporting the sleeve having a longitudinal axis;

supplying a substantially molten stream of photopolymerizable material onto the sleeve;

providing relative axial movement between the sleeve and the supply of photopolymerizable material along the longitudinal axis of the sleeve;

calendering the molten photopolymerizable material on the sleeve by metering with at least one rotating calender roll the photopolymerizable material to have a substantially constant thickness on the sleeve and rotating the sleeve to polish an outer circumferential surface of the material to a seamless uniform state.

12. The process of Claim 11 further comprising:

supporting the sleeve on a substantially rigid and thermally stable sleeve support such that the sleeve and sleeve support act as a unitary structure, the sleeve support having a longitudinal axis and adapted to be mounted onto a mandrel;

providing relative axial movement between the sleeve support and the supply of photopolymerizable material along the longitudinal axis of the sleeve support;

calendering the molten photopolymerizable material on the sleeve by metering with at least one rotating calender roll the photopolymerizable material to have a substantially constant thickness on the sleeve and rotating the sleeve support to polish an outer circumferential surface of the material to a seamless uniform state.

13. The process of Claim 10 comprising the steps in the following order:

forming the photopolymerizable layer on the cylindrically-shaped support;

heating the exterior surface of the photopolymerizable layer opposite the support;

applying particulate material to the exterior surface of the photopolymerizable layer; and

cooling the support side of the photopolymerizable element.

14. The process of Claim 1 wherein forming the layer of photopolymerizable material comprises:

supplying a substantially molten stream of photopolymerizable material onto the support; and

calendering the molten photopolymerizable material on the support by metering with a rotating calender roll the photopolymerizable material to have a substantially constant thickness on the support and to polish an exterior surface of the material to a uniform state.

15. The process of Claim 1 wherein the support is selected from the group consisting of a sheet support, and a web support.

16. The process of Claim 1 wherein the applying of the particulate material is forming a layer of particulate material on the exterior surface of the photopolymerizable layer.

17. The process of Claim 16 wherein the particulate layer is transparent or opaque to actinic radiation.

18. The process of Claim 17 wherein the particulate layer is opaque to actinic radiation and absorbs infrared radiation.

19. The process of Claim 1 further comprising:

applying additional particulate material to the surface of the photopolymerizable layer after the first applying of particulate material.

20. The process of Claim 19 wherein the additional particulate material is the same or different as the first particulate material.

21. The process of Claim 1 wherein the step of forming and the step of applying occur at the substantially the same time.

22. The process of Claim 1 wherein the step of forming and the step of applying occur sequentially.

23. The process of Claim 1 wherein the photopolymerizable element has a leading end and a trailing end, and wherein the layer of photopolymerizable material is formed at the leading end and the applying of particulate material occurs at the leading end as the layer of photopolymerizable material is forming at a trailing end.

24. The process of Claim 1 wherein the layer of photopolymerizable material is formed completely on the support before applying of the particulate material to the exterior surface.

25. The process of Claim 1 wherein the step of forming and the step of applying occur at substantially the same time, and further comprising a subsequent step of applying additional particulate material to the surface of the photopolymerizable layer.

26. The process of Claim 1 further comprising:

providing relative movement between the layer of photopolymerizable material and the particulate material being applied.

27. A process for forming a photopolymerizable element useful as a flexographic printing plate having at least one layer of particulate material comprising:

forming a layer from a molten photopolymerizable material onto a support; and

applying the particulate material onto an exterior surface of the photopolymerizable layer opposite the support within 48 hours of forming the layer of photopolymerizable material and when the surface of photopolymerizable layer has a temperature greater than 30 °C.

28. The process of Claim 27 wherein the temperature of the exterior surface of the photopolymerizable layer is greater than 35 °C.

29. The process of Claim 27 wherein the appying of particulate material occurs within 2 hours of forming the layer and when the surface of photopolymerizable layer has a temperature between 40 and 90 °C.

30. The process of Claim 27 wherein the applying of the particulate material occurs within 24 hours of forming the layer.

31. The process of Claim 27 further comprising:

altering the temperature of the exterior surface of the photopolymerizable layer by heating, cooling, or a combination of heating and cooling.

32. The process of Claim 27 further comprising:

providing relative movement between the layer of photopolymerizable material and the particulate material being applied.

33. An apparatus for forming a photopolymerizable element useful as a flexographic printing plate comprising:

means for forming a layer of a molten photopolymerizable material onto a support;

means for applying particulate material onto an exterior surface of the photopolymerizable layer opposite the support; and

means for providing relative movement between the layer of photopolymerizable material and the means for applying particulate material, wherein the exterior surface of the photopolymerizable layer has area portions each of which experience the same or substantially the same particulate application conditions.

34. The apparatus of Claim 33 wherein the means for applying particulate material comprises an application assembly comprising:

an applicator pad having surface portions for contacting the particulate material to the exterior surface of the photopolymerizable layer so that each of the area portions of the exterior surface experience the same or substantially the same particulate application conditions by contacting all or substantially all of the surface portions of the pad.

35. The apparatus of Claim 34 wherein the applicator pad is cylindrically-shaped.

36. The apparatus of Claim 35 wherein the application assembly further comprises:

means for rotating, oscillating, or both rotating and oscillating the applicator pad.

37. The apparatus of Claim 34 wherein the application assembly further comprises:

a dispensing assembly for supplying and dispensing the particulate material to the applicator pad.

38. The apparatus of Claim 33 wherein the support is a cylindrically-shaped sleeve.

39. The apparatus of Claim 37 further comprising means for rotating the sleeve.

40. The apparatus of Claim 33 wherein the support is a cylindrically-shaped sleeve having an axial length and the means for applying the particulate material comprises an application assembly comprising an application pad having an axial length that is shorter than the axial length of the support.

41. The apparatus of Claim 33 wherein the support is a cylindrically-shaped sleeve having an axial length and the means for applying the particulate material comprises an application assembly comprising an application pad having an axial length that is equal to or longer than the axial length of the support.

42. The apparatus of Claim 33 further comprising:

means for altering the temperature of the exterior surface of the photopolymerizable layer.

43. The apparatus of Claim 42 wherein the means for altering the temperature is by heating and is selected from the group of conduction, convection, radiation, or combinations thereof.

44. The apparatus of Claim 42 wherein the means for altering the temperature is by cooling.

45. The apparatus of Claim 33 further comprising:

means for altering temperature of the photopolymerizable layer by heating or cooling the support side of the layer.

46. The apparatus of Claim 33 wherein the support is a cylindrically-shaped sleeve having a longitudinal axis and the means for forming a layer of photopolymerizable material comprises:

supplying a substantially molten stream of the photopolymerizable material onto the sleeve;

providing relative axial movement between the sleeve and the supply of photopolymerizable material along the longitudinal axis of the sleeve;

calendering the molten photopolymerizable material on the sleeve by metering with at least one rotating calender roll the photopolymerizable material to have a substantially constant thickness on the sleeve and rotating the sleeve to polish an outer circumferential surface of the material to a seamless uniform state, thereby forming a seamless photopolymerizable layer on the sleeve.

47. The apparatus of Claim 33 wherein the forming means further comprises:

an extruder station for providing the photopolymerizable material in a molten state onto the support; and

a calender assembly comprising at least one calendering roll for metering the molten photopolymerizable material to form the layer on the support and polish the exterior surface of the layer.

48. The apparatus of Claim 33 further comprising:

an assembly for loading the support on to a mandrel and unloading the photopolymerizable element from the mandrel.

49. The apparatus of Claim 33 further comprising:

a loading assembly for loading the support onto a mandrel; and

an unloading assembly for unloading the photopolymerizable element from the mandrel.

50. An apparatus for applying particulate material on a photopolymerizable element useful as a flexographic printing plate comprising:

means for mounting the photopolymerizable element having a layer of photopolymerizable material on a support;

means for applying the particulate material onto an exterior surface of the photopolymerizable layer opposite the support; and

means for providing relative movement between the photopolymerizable layer and the means for applying the particulate material, wherein the exterior surface of the photopolymerizable layer has area portions each of which experience the same or substantially the same particulate application conditions.

51. The apparatus of Claim 50 wherein the means for applying particulate material comprises an application assembly comprising:

an applicator pad having surface portions for contacting the particulate material to the exterior surface of the photopolymerizable layer so that each of the area portions of the exterior surface experience the same or substantially the same particulate application conditions by contacting all or substantially all of the surface portions of the pad.

52. The apparatus of Claim 51 wherein the applicator pad is cylindrically-shaped.

53. The apparatus of Claim 51 wherein the application assembly further comprises:

means for rotating, oscillating, or both rotating and oscillating the applicator pad.

54. The apparatus of Claim 51 wherein the application assembly further comprises:

a dispensing assembly for supplying and dispensing the particulate material to the applicator pad.

55. The apparatus of Claim 50 wherein the support is a cylindrically-shaped sleeve.

56. The apparatus of Claim 50 further comprising:

means for altering the temperature of the exterior surface of the photopolymerizable layer.

57. The apparatus of Claim 56 wherein the means for altering the temperature is by heating the exterior surface to at least 30 °C and is selected from the group of conduction, convection, radiation, or combinations thereof.

58. The apparatus of Claim 56 wherein the means for altering the temperature is by cooling.

59. The apparatus of Claim 50 wherein the support is a cylindrically-shaped sleeve and further comprises means for rotating the sleeve.

60. The apparatus of Claim 59 wherein the sleeve can be rotated at the same or different rotational speed of the applicator pad.

61. An apparatus for applying particulate material on a photopolymerizable element useful as a flexographic printing plate comprising:

means for mounting the photopolymerizable element having a layer of photopolymerizable material on a cylindrical support;

means for applying the particulate material onto an exterior surface of the photopolymerizable layer opposite the support, wherein the means for applying comprises an applicator assembly having a cylindrical applicator pad; and

means for heating the exterior surface of the photopolymerizable layer.